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ABSTRACT

A child whose behavior reflects only perception of a stimulus and reaction to it is considered more perceptually bound than an adult whose behavior is also directed by theories, values, and ideas. Based on this analysis three testable hypotheses emrege: (1) stimulus complexity is a better predictor of attention for the more perceptually bound, (2) the less perceptually bound, the more likely the individual would be to recall non-perceptual attributes of stimuli, and (3) the less perceptually bound, the more likely the individual would be to respond affectively to the non-perceptual attributes of the stimuli. Television commercials were chosen as the stimuli in a study in which 120 nursery, kindergarten, and second grade children from upper-middle-class neighborhoods in St. Paul, Minnesota, viewed a videotaped presentation of "The Partridge Family." The original commercials were deleted from the tape and commercials controlled for stimulus complexity and content were inserted. During and after the program, tests were administered to measure the children's degree of perceptual boundedness and the nature of their recall and affective responses to the commercials. Resulting data suggest that the younger the child, the greater the influence of perceptual attributes of stimuli on his attention behavior. (EE)

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THE ROLE OF STIMULUS COMPLEXITY IN CHILDREN'S ATTENTION TO TELEVISION COMMERCIALS: A DEVELOPMENTAL STUDY*

by

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The study of mass media effects on children is made particularly difficult because it is necessary to specify not only what social and psychological processes mediate the effects but also how these processes change as the child matures. The descriptive data and theoretical formulations of developmental psychology provide an invaluable foundation for research in this socially significant area. This study concerning the role of stimulus or style variables on children's attention to television commercials rests on such a foundation as provided by theorists of cognitive development, particulary Jean Piaget.

At the most general level, cognitive development may be conceptualized as a progressive consolidation of mental abilities (called structures by Piaget) which mediate the linkage between the perception of a stimulus and the response to it. The neonate with almost total absence of mediating structures typically only senses and reacts whereas the older child with at least a few mediating structures senses, thinks and acts. As the structures develop, the child's ability to mediate between sensing and acting becomes more and more efficient. It is important to note that the consolidation of structures is not simply the addition of one structure on top of another, but also the evolution of crude, inefficient structures into elegant, efficient ones.

Cognitive theorists other than Piaget have studied this developmental trend which the authors have chosen to call "perceptual boundedness." For example, Wohlwill suggeststhat a basic dimension of cognitive development may be conceptualized as the movement from "perception to inference," that is, behavior guided by only perception to behavior guided by abstract thought. (Wohlwill, 1970). But the most vivid account of this developmental trend is probably Piaget's description of his proposed cognitive stages. (Flavell, 1963).

In the sensori-motor stage (0-2 years) the infant's behavior is not mediated by thought at all but rather by set behavior patterns called schema. For example,

the infant may see an object then reach for and grasp it but he does not "think" about what he is doing. In the pre-operational stage (2-7 years) the child is developing symbolic abilities (such as language and mental imagery) but his behavior is still very closely linked to perception. Piaget characterizes the mental processes of this stage as a "mental experiment" in which the child's mental life is no more than a replication in mental imagery of various stimuli which often bear no logical relation to each other. In the concrete-operational stage (7 to 12 years) the child has developed conceptual skills which enable him to effectively mediate perceptual activity, but only when dealing with concrete objects. For example, the child can sort objects into subordinate and supraordinate classes and answer questions about the inclusion of one class in another but only if the objects are visually present. Finally, in the formal-operational stage (adolescence through adulthood) the individual develops the ability to mediate perceptual activity with abstract thought. Thus, in this stage, the individual is released from the need for constant perceptual information to direct his behavior and now may be directed by theories, values and ideas which have no referent in perceptible reality.

Treating these four stages as data points, a developmental continuum emerges. The perceptual boundedness concept describes this continuum and may be conceptually defined as the degree to which cognitive mediating structures are absent. Thus the infant whose behavior is closely linked to perception is high in perceptual boundedness, and the adult whose behavior may be (but isn't necessarily) mediated by abstract thought is very low in perceptual boundness.

Based on this analysis a theoretical premise emerges: The more perceptually bound the child, the greater the influence of the perceptual attributes of stimuli on his behavior.

For the purpose of specifying at least one of the ways which perceptual attributes of a stimulus may influence behavior a second premise must be added: For children younger than middle childhood (0-8 years), the greater the perceptual complexity of a stimulus the greater the attention to it. A number of studies have found a relation between duration of attention and the perceptual complexity of stimuli, operationalized as the number of angles in a geometric shape. The relationship is generally positive and monotonic for children younger than middle childhood, but becomes U-curved thereafter, with moderately complex stimuli receiving more attention than either very simple or very complex stimuli. (Hershenson, Munsinger and Kessen, 1965; Munsinger, Kessen and Kessen, 1964; Munsinger and Weir, 1967). Berlyne reports several studies in which the stimulus complexity variables have been related to the information theory variables of redundancy and uncertainty although all the studies used inanimate drawings as stimuli. (Berlyne, 1954a; Berlyne 1954b; Berlyne, 1958). The study reported here extends the research on stimulus complexity into the area of visual auditory complexity of animated stimuli, i.e. television commercials, using an information theory measure of stimulus complexity.

Based on these premises, several testable hypotheses may be formulated: (1) When exposed to stimuli which vary both in stimulus complexity and content, the more perceptually bound the child, the more likely he is to attend differentially to the stimuli based on complexity with high complexity stimuli receiving most attention and low complexity stimuli receiving least. Thus we expect stimulus complexity to be a better predictor of attention for the more peceptually bound child than for the less bound child. It would be expected that one or more content (conceptual dimensions) would be a better predictor of attention for the less bound child since this child has more structures to make use of conceptual information.

However, we are not attempting to predict or test for these dimension. (2) The less perceptually bound the child, the more likely he is to recall non-perceptual attributes of the stimuli. (3) The less perceptually bound the child, the more likely he is to respond affectively to the non-perceptual attributes of the stimuli when asked for an affective response to the stimuli.

Method

Television commercials were chosen as the stimuli and rated for stimulus complexity in terms of an information theory measure of television content developed by James Watt and Robert Krull (Watt and Krull, 1972). This measure equates entropy, or randomness of change, with the information theory concept of uncertainty in the receiver of a message. The technique measures the entropy levels of six iconic (perceptual) attributes of television content to derive uncertainty variables.*

Watt and Krull report that when prime-time television shows were rated on these uncertainty variables and the results factor analyzed, two factors, named dynamics and unfamiliarity emerged accounted for 76% of the variance.**

*Watt and Krull measure six entropy variables: (1) set time entropy, which is the degree of randomness of the time of visual duration of discrete physical locations; (2) set incidence entropy, which is the degree of randomness of the appearance of discrete physical locations; (3) verbal time entropy, which is the degree of randomness of the time of audible behaviors on the part of the program's characters; (4) verbal incidence ntropy, which is the degree of randomness of the performance of audible behaviors on the part of the characters; (5) set constraint entropy, which is the degree of randomness of the appearance of interior walls of a set; (6) non-verbal dependence entropy, which is the degree of randomness of the time of non-verbalization by characters.

**Factor one, dyncamics was most heavily loaded on verbal time entropy, verbal incidence entropy and set time entropy. Factor two, unfamiliarity, was composed of set constraint entropy and non-verbal dependence entropy. When prime-time shows ere plotted on the two dimensions formed by these factors, the shows ere found to be roughly divided into such content categories as situation comedy, variety and adventure. Also, the factor ratings were found to be related to perceived violence scores of the shows.

When forty commercials were rated on the variables and factors analyzed, two distinctly different factors emerged.*** Factor one was heavily loaded with the visual indicators, while factor two was loaded with the verbal auditory indicators except for non-verbal dependence entropy which was evenly divided between the two factors. Thus it appears that the visual and auditory channels are treated seperately in the commercials in our sample as compared to prime-time shows in which they are intertwined. The visual and auditory factors were considered to be two dimensions of commercials and the score on the dimensions are used as the operationalization of stimulus complexity.

Two methods are used to operationalize the perceptual boundedness variable. One method assumes that perceptual boundedness is very closely related to age and uses age as the indicator. This method was used by Flavell in his study of role taking skills which was based on a Piagetian stage analysis (Flavell, 1968) and is a common practice in developmental psychology.

The second method uses a scale designed to tap the perceptual boundedness dimension of cognitive development. The scale consists of three questions which ask the difference between pairs of items with which children are familiar. The questions are: what is the difference between a car and a truck, between school and home and between a mother and a father? Each of these pairs can be distinguished by differences in perceptual attributes (such as appearance or activities) or by differences in conceptual attributes (such as functions). Piagetian theory deals with the highest level of cognitive functioning of which the child is capable rather than the level at which he most often operates. Thus, the second operationaliztion of perceptual boundedness is highest level response (from perceptual to

***The forty commercials in no way constituted a random sample but rather were selected to obtain as much variance on the six variables as possible.

conceptual) on the constructed measure.

This scale is an extension of one used by Ward and Wackman (in press) which employed the single question: what is the difference between a television show and a television commercial? They found that the perceptual-conceptual distinction in the children's responses correlated with age. They also found that the measure discriminated between levels of attention to televised commercials. The present study replicated this question although it was not included in the scale.

The measure of the dependent variable, attention, employed a scheme used by Ward, Levinson and Wackman (1972). Attention was coded as full, partial or none at given observation intervals. Full attention was recorded when the child was in a viewing position with eyes on screen; partial attention occurred when the child was in a viewing position but with eyes off the screen or apparently not listening (also when the child is verbally or physically reacting to the television content); no attention indicated the child was not in a viewing position and eyes were not on the screen. For this study the observation intervals were immediately prior to the beginning of the commercial, at the onset and at ten-second intervals throughout the commercial. Observations were also made at three 10-second intervals after the resumption of the program.

The meaure of the nature of recall and affect employed a content analysis of the subjects' recall of and affective responses to the commercials shown them in the experimental treatment. The categories for this analysis were: (1) statements concerning perceptual attributes of the commercials (references to perceptible reality such as objects or actions seen, or sounds heard) (2) statements concerning conceptual attributes of the commercials (references to functions or evaluations of the products, the commercial or advertising itself). The measure of both recall and affect is, then, the proportion of conceptual responses to total

number of responses made.

The experimental treatment was a videotaped presentation of the situation comedy program, "The Partridge Family." This program is rated as moderately dynamic and moderately unfamiliar on the Watt and Krull ratings of prime-time shows. The original commercials were deleted from the tape and commercials controlled from stimulus complexity and content were inserted. Twelve commercials grouped into three blocks were used. The first block (irrelevant) was composed of four commercials concerning products with low relevance for children (gasoline and health products) varying in complexity as indicated in Table 1. The second block (relevant consisted of three commercials concerning foods assumed to be popular with children, also varying in complexity as indicated. The third block consisted of five commercials also concerning such foods and varying as indicated.

(Table one about here)

Four versions of the program were used, with the commercials rotated within the blocks so that each appeared as the first commercial in the block in one of the versions (except, of course, for block three in which only four of the five could appear first). Blocks were NOT rotated within the program; this precludes the use of commercial content as an independent variable due to fatigue factors.

Subjects are 40 nursery school children (3-4 years, pre-operational stage) from two nuersery schools in suburban St. Paul, Minnesota, 40 kindergarteners (5-6 years, transitional) and 40 second graders (7-8 years, concrete-operational) both from an elementary school also in suburban St. Paul. All three schools are in upper middleclass neighborhoods. Within each of the three levels, 10 children were randomly assigned to view each of the four versions.

Subjects viewed the program in pairs in rooms in their school which were familiar to them but not actual classrooms. Two experimenters, one of the

principal investigators and one undergraduate assistant, were present. The children were ushered into the room by one of the experimenters and an effort was made to put them at ease. Subjects were told the experimenters wanted to ask them some questions about what they liked on television but first they could watch a television show while the experimenters did some work. The subjects were told that they did not have to watch the show and could talk or move about the room until the experimenters were finished with their work. The videotape unit was then turned on and each experimenter recorded the attention of one child from a position to the side of the child and slightly behind him. Inter-observer reliability on a subsample of subjects was 90.6%.

After the program the children were separated and the perceptual boundedness scale was administered. The subjects were then asked to recall the commercials they had seen and were probed for as much information as they could produce. The children were also separately re-exposed to seven of the commercials and asked for their affective response to each commercial.

ANALYSES USING AGE AS THE INDEPENDENT VARIABLE

Analysis of Attention Data

Analysis of the attention data employed the observations of the first seven commercials, i.e., the first two blocks. It is these two blocks which contain the extremes of high visual-high auditory and low visual-low auditory and thus should provide the clearest picture of the effect of stimulus complexity on attention.

According to hypothesis one, differences in stimulus complexity should produce differences in attention with the most complex (high-high) commercial receiving most attention and the least complex (low-low) receiving least. This difference should, however, decrease with age. To test this prediction, mean attention to each of the commercials was computed by age. The attention score was

derived by weighting each observation according to attention level (full attention=6, partial attention=5, no attention=4) and averaging across all observations of a commercial for each age group. The attention scores were then subjected to a two-way analysis of variance with repeated measures. This analysis has the advantage of utilizing the multiple treatment conditions of the experimental design, i.e., four irrelevant and three relevant commercials all either high or low in the visual and auditory stimulus complexity factors. A separate analysis was conducted on each of the two blocks.

(Table Two about here)

Table two presents the analysis of the attention scores for the irrelevant product commercial block. Age had a statistically significant main effect on attention ($F=9.17$, $p<.01$). The stimulus complexity main effect was also statistically significant ($F=7.40$, $p<.01$). However, the age by stimulus complexity interaction, which would indicate the predicted differences in the effect of complexity according to age, fell short of statistical significance ($F=1.40$, $.25<p<.10$).

Table 3(A) indicates that the kindergarteners had the highest mean attention (5.78) and the nursery schoolers the lowest mean attention (5.38) to the four commercials in the irrelevant product block.

(Table Three about here)

Table 3B indicates attention to the commercials was highest for the high visual, high auditory commercial (5.70) and lowest for the high visual, low auditory commercial (5.53). Contrary to hypothesis one, the low visual, low auditory commercial did not receive the lowest mean attention score (5.56). However, as predicted, the difference in attention to the high-high and low-low commercials was largest for the nursery schoolers (5.49-5.28=.21). The next largest difference was for the kindergarteners (5.84-5.69=.15), and the smallest difference was for the second graders (5.76-5.72=.04). As indicated earlier,

this age by stimulus complexity interaction was not statistically significant.

(Table Four about here)

Table Four presents the analysis of the mean attention scores for the relevant product commercials (block two). Again age had a significant main effect on attention ($F=21.38$, $p < .01$), as did stimulus complexity ($F=8.64$, $p < .01$). In the case of the relevant commercials, the age by stimulus complexity interaction was significant ($F=4.54$, $p < .01$).

(Table Five about here)

As Table Five indicates, attention to the relevant product commercials was not ordered according to stimulus complexity. The low visual, high auditory commercial had the highest mean attention score (5.72), and the low visual, low auditory commercial the lowest (5.58). The differences in attention tothe high-high versus the low-low commercial was highest for nursery schoolers (.26). There was little difference for kindergarteners (.04) and second graders (.10). See Table Six.

(Table Six about here)

In summary, then, the data yield mixed support for hypothesis one. For the irrelevant commercials, the age x stimulus complexity interaction, which bears directly on the hypothesis, does not reach statistical significance, although the differences in attention do decline in the predicted manner. For the relevant commercials the interaction is statistically significant.

Explanation of these mixed results is made difficult by the fact that the experimental design confounds product category with placement of the blocks within the program, e.g., irrelevant-product commercials were always the first block within the program. Inspection of the sum of squares columns in tables two and four indicates that there was a larger standard error in the first block of commercials. This could have occurred because the children had not become

accustomed to the experimental environment by the time of the first block of commercials. Thus the variance in this block could have been increased by frequent shifts in attention due to simultaneous interest in the television and other aspects of the environment. By the second block the children's attention may have stabilized either on the television or some other feature of the environment resulting in the smaller standard error and clearcut stimulus complexity effect.

One facet of the data which bears on this issue is the stability of the subjects' attention from one observation to the next within each commercial. If factors other than the interest value of the commercial were influential, then it is to be expected that stability within the commercials would be less than if such factors were not influential. Table Seven presents the percentage of stable and unstable transitions for the irrelevant and relevant product blocks. A stable transition occurs when the subject's attention level does not change from one observation to the next, while an unstable transition occurs when the attention level does change. The N's indicate the total number of observations recorded for each of the age groups.

(Table Seven about here)

This table indicates that there was noticably greater stability in the relevant commercial block for both nursery schoolers and second graders (an 8% increase from irrelevant to relevant commercial block). While the kindergarteners showed little increase (.2%), it is apparent that they were already quite stable (82% stable transitions). The stability data thus lend support to a placement effect argument.

Further analysis of attention data

Several other facets of the attention data were analyzed in addition to that bearing directly on hypothesis one.

For both the irrelevant and relevant product commercial blocks, mean attention to commercials high on the auditory channel was greater than mean attention to commercials low on this channel no matter what the visual channel rating (see Tables 3B and 5B). This suggested an analysis of the visual channel alone in predicting attention. A three way analysis of variance with repeated measures was conducted on the irrelevant commercial block. This block is composed of a complete set of stimulus complexity rating combinations, i.e., high-high, low-high, high-low and low-low. Table Eight presents these results.

(Tables Eight and Nine about here)

As Table Eight indicates, the auditory rating alone had a significant main effect on attention ($F=20.60$, $p < .01$). The mean attention score for those commercials with a high auditory rating was 5.68 and for those with a low auditory rating was 5.55 (see Table 9A). No significant main effect was found for the visual factor. Also, no interactions are statistically significant although the three-way interaction (age by visual by auditory) approaches significance ($F=2.45$, $.05 < p < .10$).

While the theoretical framework of this study does not account for the differential effects of the visual and auditory channels, a post hoc explanation in terms of information processing theory may be advanced. The information processing theorist, Herbert Simon (Simon, 1972), argues that children learn to process auditory stimuli more readily than visual stimuli as indicated by the fact that children learn to talk much more readily than they learn to read. Simon suggests that this may be due to differences between the right hemisphere of the brain where visual information is stored and the left hemisphere where auditory information is stored. It may well be that this visual-auditory differentiation is reflected in attention behavior.

Further indication of the influence of the auditory channel on attention is

found in the "attention profile" for each of the commercials. The attention profile is the level of attention for each observation within a commercial. Figure One summarizes the initial movement toward full attention which occurs between the observation immediately prior to the beginning of the commercial and the observation in the first few seconds of the commercial's onset.

(Figure One about here)

As this figue indicates those commercial with high auditory ratings exhibit more movement toward full attention than those with low auditory ratings while the visual ratings appear to have little effect. Also, for the high auditory commercials, the decline in attention is more gradual than for the low auditory commercials.

Thus it appears that the children at all three age levels can and do discriminate the end of one commercial from the beginning of the next, and ability which has been called into question by other research (Ward and Wackman, 1973). Furthermore, this discrimination appears to be aided by high auditory entropy. Common sense suggests that only the auditory channel can draw the attention of subjects who are not actually looking at the television set. Note that high auditory entropy does not necessarily mean noise or loudness, but rather randomness of verbalization. However, it does appear that it is associated with cues which do aid discrimination or draw attention.

Further analysis of the stability of attention from one observation to the next was also conducted. Table Ten presents the percentage of stable and unstable transitions for each age group averaged across all seven commercials. The data is further broken down according to the level of attention prior to the beginning of each transition.

(Table Ten about here)

As this table indicates when attention prior to the transition is full it is likely to remain full for all age groups, but more so for the kindergarteners

and second graders. When the prior observation indicated full attention 79.1% of the nursery schoolers' subsequent transitions were stable at full attention while 88.7% of the kindergarteners' transitions and 88% of the second graders' transitions remained stable at full attention.

Partial attention is a transitional state as indicated by the fact that when the prior observation indicated partial attention, subjects of all ages were more likely to change attention level than to remain stable. A very large percentage of these unstable transitions are movements toward full attention.

The data concerning stability when the prior observation indicates no attention is inconclusive for the kindergarteners and second graders due to small N's. For nursery schoolers, at least, no attention is a stable state much like full attention. When the prior observation indicated no attention 76.2% of the nursery schoolers remained stable at no attention.

Analysis of Recall and Affect Data

Hypothesis two predicts that the less perceptually bound (the older) the child, the more likely he is to recall the non-perceptual attributes of the stimuli. To test this prediction the content of the subjects' recall of the first commercial recalled was coded into four categories. Two categories were perceptual (number of objects recalled and number of activities recalled) and two categories were conceptual (number of verbal assertions about the product recalled and number of conceptual attributes of the product recalled). An analysis of variance using age as the independent variable was conducted on the mean proportion of conceptual attributes to total attributes recalled. Table Eleven presents the results.

(Table Eleven about here)

As this table indicates the F value (12.51) is statistically significant at the .001 level. While there are certain statistical irregularities of the data,

Table Twelve does indicate that the proportion of conceptual attributes recalled does [illegible]ase with age.*

(Table Twelve about here)

Hypothesis three predicts that the less perceptually bound (the older) the child, the more likely he is to respond affectively to non-perceptual attributes of the stimuli. To test this prediction the affective response to each of the seven commercials was coded into one of five categories. Three categories were perceptual (responses to objects, responses to activities and generalized responses to the product itself) and two categories were conceptual (responses to product function and responses to advertising function). The mean proportion of conceptual responses to total responses for each of the three age groups were subjected to an analysis of variance. Table Thirteen presents the results.

(Table Thirteen and Fourteen about here)

As this table indicates the F value (13.388) is significant at the .001 level. Affective responses clearly increases with age as indicated by Table Fourteen.

In summary, analyses using age as the indicator of perceptual boundedness found mixed support for the attention hypothesis. Hypotheses two (recall) and three (affect) were clearly supported.

ANALYSES USING PERCEPTUAL BOUNDEDNESS SCORE AS THE INDEPENDENT VARIABLE

Perceptual boundedness score

The attempt to construct a direct measure of perceptual boundedness for use as an independent variable met with mixed success.

Three items composed the perceptual boundedness scale (What is the difference between a car and a truck, school and home and mother and a father?). Since Piagetian theory deals with the highest level of cognitive functioning of which

*Inspection of Table Twelve indicates that the standard deviation is very different for the three groups, and secondly, the standard deviations are larger than the means. These same statistical problems are found in the analysis of the affect data.

the child is capable rather than the level at which he most often operates an overall subjective judgment of the responses made to these three items was made. Overall response was coded as either perceptual (the responses focused on perceptual attributes or simple activities), transitional (the responses did not indicate a true grasp of functional differences but did focus on activities related to function) or conceptual (responses focused on functional differences).

Coding of the overall judgment was necessarily subjective and the coders were conservative in their judgments as indicated by the fact that only four subjects were judged to be in the conceptual category. Intercoder agreement was 81%.

Because of the small number of conceptual subjects the conceptual and transitional categories were collapsed into a single category. The perceptual category (N=83) contained 35 nursery schoolers, 35 kindergarteners and 15 second graders while the transitional/conceptual category (N=30) contained 7 kindergarteners and 23 second graders. Five nursery schoolers and two second graders did not complete the scale.

The perceptual and transitional/conceptual categories were used as the independent variable in tests of the three hypotheses. To test hypotheses one, mean difference scores, i.e., attention to the low-low commercial subtracted from attention to the high-high commercial, of these two groups was compared by a one-tailed T test for both the irrelevant and relevant product commercial blocks. Neither T value was significant. Table Fifteen presents these results.

(Table Fifteen about here)

Test of hypotheses two and three using the perceptual and transitional/conceptual categories as the independent variable produced statistically significant results. A one-tailed T test on the proportion of conceptual attributes to the total number of attributes recalled produced a T value of 3.07 which was significant beyond the .001 level. A one-tailed T test on the

proportion of conceptual attributes named in affective responses to total number of attributes produced a T value of 2.96 which is statistically significant beyond the .001 level.

(Table Sixteen and Seventeen about here)

In summary, analyses using the perceptual boundedness score as the independent variable had mixed results. Hypothesis one was not supported. Hypotheses two and three were clearly supported.

Conclusions

The concept, perceptual boundedness, suggest that the younger the child, the greater the influence of perceptual attributes of stimuli (television commercials) on his attention behavior. The data provides at least some evidence that this is true although the overall inference drawn from these results needs further qualification. The uniformly high mean attention scores of the kindergarteners and second graders, indicates that the older children found the stimuli more interesting than the nursery schoolers, or perhaps that the older children perceived the experimental situation as part of their school work and felt obliged to attend closely. Whatever the cause of this high attention for the older children it does raise the possibility that a ceiling effect may have depressed the differences scores of these children.

The possibility of such as experimental artifact clouds the inferential picture which may be drawn from the data and the issue of whether or not the influence of perceptual attributes declines with age remains open to debate. However, taken at face value the data does indicate such a decline although some influence of stimulus characteristics clearly is still present in second grade as indicated by the fact that high-high commercials still receive more attention than low-low commercials. Similarly, the data collected in support of hypotheses two and three show an increase in conceptual content of recall and affective

responses although the proportion of conceptual to total attributes mentioned remains very small even in second grade. Thue, while a shift in orientation from stimulus to conceptual attributes is underway by second grade, it is not very far along as indicated also by the perceptual boundedness scores of the second graders. The data taken as a whole suggest that even second graders, while influenced by conceptual attributes, are still also strongly influenced by stimulus attributes. A wider age range, as well as methodological adjustments to guard against a ceiling effect, may be necessary to clearly demonstrate a clearcut decline in the influence of perceptual attributes.

At the least it may be justifiably concluded that stimulus complexity does indeed have an influence on the attention of our nursery school through second grade subjects. Furthermore, the Watt and Krull information theory measure has been demonstrated to be a successful method for measuring these attributes. This measure is sensitive to, although not a direct measure of, such stylistic characteristics of television as tempo of editting, use of music, in addition to pace of action etc. Given the small amount of variance (about 2%) explained by stimulus complexity, future research may profitably be directed toward sorting out the effects of these variables, perhaps using the shot, rather than the set as the Watt and Krull measure uses, for the unit of analysis.

Another area which deserves further attention is the differential effects of the visual and auditory channels. This unpredicted result may indicate that two concepts--auditory boundedness and visual boundedness--ought to be substituted for perceptual boundedness. Information processing theory might provide the best approach to examining this area.

TABLE 1

STIMULUS COMPLEXITY RATINGS OF COMMERCIALS

	Product	Visual Complexity Score	Auditory Complexity Score	Length
BLOCK 1	Clark Oil	High (.91875)	High (.89186)	30 seconds
	Clorets	Low (-1.5997)	High (1.1860)	30 seconds
	Skelgas	High (1.4379)	Low (-1.4194)	30 seconds
	Bromo Seltzer	Low (-1.8772)	Low (-1.5517)	30 seconds
BLOCK 2	Hershey Instant	High (1.2680)	High (1.0437)	60 seconds
	Burger King	Low (-1.7144)	High (1.17436)	30 seconds
	Gatorade	Low (-1.1343)	Low (-1.7551)	20 seconds
BLOCK 3	Wonder Bread	High (.89608)	Medium (.37739)	30 seconds
	Snickers	Medium (-.57801)	High (.70379)	30 seconds
	Hostess Snack Cakes	Medium (.81763)	Medium (-.10981)	60 seconds
	Quickick	Low (1.2175)	Medium (-.32483)	30 seconds
	Chef Boy ar dee Pizza	Medium (.41223)	Low (-1.7346)	30 seconds

TABLE 2

Two-Way Analysis of Variance with Repeated Measures of Age by Stimulus Complexity on Attention Behavior for Irrelevant Product Commercials.

Sources of Variance	Reduced Sum of Squares	Degrees of Freedom	Mean Square	F value	Prob.
Age	13.68	2	6.84	9.17	$p < .01$
S (Age)	87.24	117	.75		
Stimulus Complexity	2.15	3	.72	7.40	$p < .01$
Age x Stimulus Complexity	.82	6	.14	1.40	$.25 > p > .01$
Stimulus Complexity x S(Age)	34.21	351	.09		

TABLE 3

A. Irrelevant Product Commercial Mean Attention Scores for Each Age Group

Group	Means
Nursery	5.38
Kindergarten	5.78
Second Grade	5.68

B. Mean Attention Scores to Irrelevant Product Commercials

Commercials		Means
Visual Factor	Auditory Factor	
High	High	5.70
High	Low	5.53
Low	High	5.66
Low	Low	5.56

TABLE 4

Two-Way Analysis of Variance with Repeated Measures of Age by Stimulus Complexity on Attention Behavior for Relevant Product Commercial

Sources of Variance	Reduced Sum of Squares	Degrees of Freedom	Mean Square	F value	Prob.
Age	24.63	2	12.32	21.38	p .01
S(Age)	67.45	117	.58		
Stimulus Complexity	1.47	2	.73	8.64	p .01
Age x Stimulus Complexity	1.54	4	.39	4.54	p .01
Stimulus Complexity x S(Age)	19.93	234	.09		

TABLE 5

A. Mean Attention to Relevant Product Commercials for Each Age Group

Group	Mean
Nursery	5.30
Kindergarten	5.87
Second Grade	5.84

B. Mean Attention to Irrelevant Product Commercials

Commercial Visual	Auditory	Mean
High	High	5.71
Low	High	5.72
Low	Low	5.58

TABLE 6

Mean Attention to Each Relevant Commercial by Age Group

Commercial	Nursery	Kindergarten	Second
High visual, High auditory	5.36	5.91	5.88
Low visual, High auditory	5.46	5.84	5.87
Low visual, Low auditory	5.10	5.87	5.78
HH - LL difference	.26	.04	.10

TABLE 7

A. Stability in Attention Across Transitions in Irrelevant Product Block for All Age Groups

	Nursery	Kindergarten	Second
Percentage of Stable Transitions	67.6	82.4	75.8
Percentage of Unstable Transitions	32.4	17.6	24.2
	N = (581)	(591)	(608)

B. Stability in Attention Across Transitions in Relevant Product Block for All Age Groups

	Nursery	Kindergarten	Second
Percentage of Stable Transitions	75.7	82.6	83.7
Percentage of Unstable Transitions	24.3	17.4	16.3
	N = (560)	(552)	(552)

TABLE 8

Three-Way Analysis of Variance with Repeated Measures of Age by Auditory Factor by Visual Factor on Attention Behavior for Irrelevant Product Commercials (Block I)

Sources of Variance	Reduced Sum of Squares	Degrees of Freedom	Mean Square	F value	Prob.
Age	13.37	2	6.84	9.18	$p < .01$
S (Age)	87.24	117	.75		
Auditory	2.00	1	2.00	20.60	$p < .01$
Visual	.001	1	.001	.005	n.s.
Age x Auditory	.15	2	.07	.75	n.s.
Age x Visual	.19	2	.09	.97	n.s.
Visual x Auditory	.15	1	.15	1.55	n.s.
Age x Visual x Auditory	.48	2	.24	.25	$.05 < p < .10$
S(Age)x Visual x Auditory	34.16	351	.097		

TABLE 9

A. Irrelevant Product Commercials, Visual and Auditory Factor Mean Attention Scores

	Auditory Factor		Visual Factor
High	5.68	High	5.61
Low	5.55	Low	5.61

B. Irrelevant Product Commercials, Visual and Auditory Factor Mean Attention Scores for Each Age Group

	Visual Factor				Auditory Factor		
	Nursery	Kind.	Second		Nursery	Kind.	Second
High	5.40	5.79	5.65	High	5.47	5.84	5.72
Low	5.36	5.77	5.70	Low	5.29	5.72	5.63

TABLE 10

Stability in Attention Across Transitions of Block I and Block II for Each Age Group when Prior Attention is Full, Partial and No Attention

Full Attention Prior

Transitions	Nursery	Kindergarten	Second
Percent Stable at Full Attention	79.1	88.7	88
Percent Full to Partial Attention	18.2	10.1	11.3
Percent Full to No Attention	2.7	0.2	0.7
N =	(655)	(960)	(917)

Partial Attention Prior

Transitions	Nursery	Kindergarten	Second
Percent Stable at Partial Attention	48.6	48.6	42.8
Percent Partial to Full Attention	40.8	49.1	52.1
Percent Partial to No Attention	10.6	2.3	5.1
N =	(255)	(177)	(194)

No Attention Prior

Transitions	Nursery
Percent Stable at No Attention	76.2
Percent No to Full Attention	9.6
Percent No to Partial Attention	14.2
N =	(219)

N's refer to the number of transitions observed within each age group.

TABLE 11

One-Way Analysis of Variance on the Proportion of Conceptual Attributes to Total Attributes Mentioned by Each Age Group on First Commercial Recalled.

Sources of Variance	Degrees of Freedom	Sum of Squares	F value	Prob.
Between	2	.85	12.51	$p < .000$
Within	117	3.99		
Total	119	4.85		

TABLE 12

Mean Proportion of Conceptual to Total Attributes Mentioned of the First Commercial Recalled for Each Age Group

Age Group	N	Mean Proportion	Standard Deviation
Nursery	40	0.000	0.000
Kindergarten	40	.800	.053
Second Grade	40	.189	.316
Total	120	.064	.202

TABLE 13

One Way Analysis of Variance on the Mean Proportion of Conceptual to Total Attributes Mentioned in Affective Responses By Each Age Group

Sources of Variance	Degrees of Freedom	Sum of Squares	F value	Prob.
Between	2	1.31	13.39	$p < .000$
Within	117	5.72		
Total	119	7.03		

TABLE 14

Mean Proportion of Conceptual to Total Attributes Mentioned in Affective Responses to Commercials for Each Age Group

Grade	N	Mean Proportion	Standard Deviation
Nursery	40	0.004	.026
Kindergarten	40	.094	.192
Second Grade	40	.256	.331
Total	120	.118	.243

TABLE 15

T-Test on Attention Difference Scores Using Perceptual Boundedness as Independent Variable

Difference Scores, Relevant Commercials

Groups	N	Mean	St. Dev.	T value	df	2 tailed prob.
Perceptual	83	2.1476	.366	51*	111	p< .30
Transitional/ Conceptual	30	2.1111	.222			

Difference Scores, Irrelevant Commercials

Groups	N	Mean	St. Dev.	T value	df	2 tailed prob.
Perceptual	83	2.1024	.455	.06**	52.07	p< .47
Transitional/ Conceptual	30	2.1083	.449			

*Pooled Variance Estimate
**Separate Variance Estimate

TABLE 16

T-Test on Recall Measure

N	GROUP	MEAN PROPORTION	STANDARD DEVIATION	T-VALUE	df	PROB.
83	Perceptual	.0329	.143	3.07*	111	$p < .001$
30	Transitional/ Conceptual	.1639	.308			

*pooled variance estimate

TABLE 17

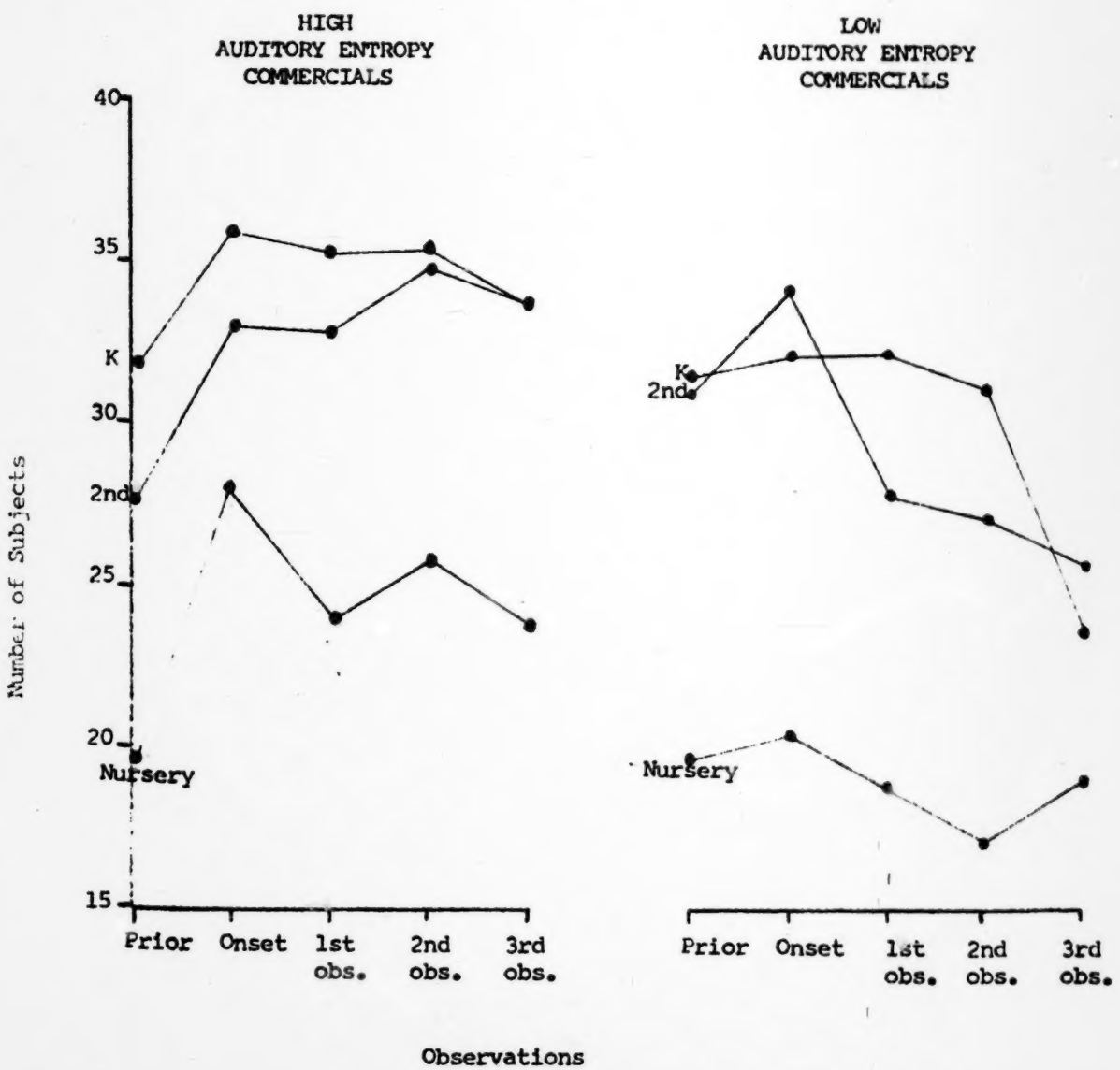
T-Test on Affect Measure

N	GROUP	MEAN PROPORTION	STANDARD DEVIATION	T-VALUE	df	TWO-TAILED PROB.
83	Perceptual	.0775	.203	3.60*	111	$p < .000$
30	Transitional/ Conceptual	.2585	.313			

*pooled variance estimate

Figure 1

Number of Subjects at Full Attention Prior to, at Onset and at First Three Observations of Commercials High and Low in Auditory Entropy



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